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HOW I DO IT

Sentinel Node Biopsy

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Like many of the important discoveries which have been made in the course of human history, the sentinel node (SN) biopsy technique is remarkably simple in concept. However, this conceptual simplicity does not mean that it is always simple in practice. Indeed, SN biopsy is sometimes a complex and challenging procedure to perform, and even after extensive experience, it is still difficult on some occasions to identify SNs with complete confidence.

Unless accurate SN identification can be achieved in a high proportion of the patients in whom it is attempted, the potential value of the SN biopsy technique is seriously diminished. For example, it is common for there to be more than one SN receiving lymphatic drainage from a melanoma in a given site [1,2], and if second, third or even fourth SNs are not identified and removed for histological examination, an incorrect conclusion about the presence or absence of micrometastatic disease in the regional lymph node field may be reached. All available technical assistance is therefore required, to minimise the risk of error.

Three separate methods are currently available for locating SNs and confirming their identity:

Preoperative lymphoscintigraphy. To achieve useful and reliable information, high quality lymphoscintigraphy is required. This involves the acquisition of both early and late images after injection of a radiolabelled colloid tracer around the primary melanoma site, and obtaining views in more than one plane. Lymphatic drainage pathways cannot be predicted on clinical grounds alone, and unless preoperative lymphoscintigraphy is performed there is a risk that draining node fields will not be identified, and SNs will therefore be missed. For example, 25% of melanomas on the back have initial lymphatic drainage to a SN in the triangular intermuscular space lateral to the scapula, rather than to the axilla or groin [3]. In some patients there is even direct drainage of lymphatics from the skin of the back through the body wall to para-aortic nodes [4], in which circumstance SN biopsy is clearly inappropriate. Drainage from the forearm may be directly to epitrochlear, interpectoral or supraclavicular SNs, as well as to the axilla [5]. Drainage from central parts of the anterior abdominal wall may be to internal mammary, rather than axillary or groin nodes [6]. For melanomas on the scalp, face or upper neck, lymphatic drainage is discordant with clinical predictions in one of every three patients [7]. For primary tumours on the lower lateral neck, drainage may be directly to axillary nodes rather than to supraclavicular nodes. In the lower limb, drainage to the contralateral groin may occur if there has been previous surgery of any kind in the ipsilateral groin, even a simple lymph node biopsy many years earlier [8].

Having determined the site of a SN by lymphoscintigraphy, ideally by identifying a discrete lymphatic channel leading into it, the nuclear medicine physician can mark the SN's position on the immediately overlying skin and give an indication of its depth beneath the skin surface. This information is of considerable value in subsequent surgical SN exposure, and helps to minimise the amount of dissection necessary to find and remove it. If more than one SN is present in a node field, it is very useful at the time of surgery to be aware of this from the results of the preoperative lymphoscintigram. This knowledge greatly reduces the risk of failing to identify and remove additional SNs. Also useful at the time of surgery is knowledge of the rate of migration of radiolabelled tracer from the primary melanoma site to the SN, because it gives an indication of when intradermal blue dye should be injected in the immediate preoperative period.

Lymphatic mapping with blue dye. Satisfactory blue staining of afferent lymphatics and SNs is usually achieved following injection of 0.5–1.0 ml of Patent Blue dye around the primary melanoma site via a 25FG needle, so that the site is completely surrounded. Care

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must be taken to ensure that the injection is intradermal and not subcutaneous, since lymphatic drainage from the subcutaneous tissues may follow different pathways. Criteria for positive identification of a SN must be rigorous. The node should correspond in position with the location indicated by preoperative lymphoscintigraphy, should have at least one definite blue stained afferent lymphatic channel entering it, and should itself be blue stained. In seeking the SN, dissection is kept to a minimum and care is taken not to divide any blue stained lymphatic channels before tracing them to a SN and removing it. If tracer movement was very slow at the time of preoperative lymphoscintigraphy, the blue dye is injected earlier than usual in the operating room prior to the SN biopsy procedure, and the patient is instructed to exercise and elevate the relevant body part to increase the rate of movement of the blue dye towards the draining lymph node field.

Intraoperative use of a gamma probe. As originally described, use of a hand-held gamma probe intraoperatively followed intradermal injection of radiolabelled colloid around the melanoma site a short time before the surgical procedure. However, at the Sydney Melanoma Unit it has been found to be not only possible but in fact more efficient to use residual activity in SNs following lymphoscintigraphy with Tc 99m antimony trisulfide colloid the previous day [9]. This simplifies logistics, reduces costs, minimises inconvenience and radiation dose for patients, and eliminates potential health and safety problems for operating theatre staff.

Use of a gamma probe can speed location of SNs (particularly in the axillae of obese patients) but, more importantly, provides immediate confirmation of SN identity. Although radioactive colloid tracer, like blue dye, eventually passes through SNs to second and third tier nodes in a regional node field, the SNs usually remain the hottest nodes in the field, even 24 hours later. Thus the presumed SN should have a high gamma count, normally at least three times the residual count in the regional lymph node field after removal of SNs. Occasionally a node at the site and depth of a SN indicated by preoperative lymphoscintigraphy is hot with the gamma probe, but no blue lymphatics or blue stained nodes can be found in the node field. Under these circumstances the node is almost certainly a SN. Virtually every patient in whom this situation arises will have very slow tracer migration on the preoperative lymphoscintigram, and if the measures outlined above are taken when slow tracer migration is observed, the problem rarely occurs.

There are important reasons why it is likely to be unreliable to attempt SN identification using the gamma probe alone, without previous lymphoscintigraphy or blue dye injection [10]. The principal problem is that some non-SNs can quite quickly accumulate tracer and become hot, and if information about afferent lymphatic channels is not available from either a previous lymphoscintigram or as a result of blue dye injection, nodes other than SNs will be removed. This is unsatisfactory, and defeats the basic purpose of the SN biopsy procedure, which is to be selective and remove only SNs. Much more unsatisfactory, however, is failure for whatever reason to identify and remove all true SNs. The risk of this occurring can be minimised by using all three of the available methods which have been discussed.

TABLE I. Sentinel Node (SN) Biopsy Procedures June 1992–October 1996

Lymph node field		Confident SN identification		Non-confident SN identification or SN not found	
Axilla	(n = 171)	156	(91.2%)	15	(8.8%)
Groin	(n = 116)	116	(100.0%)	0	(0.0%)
Neck	(n = 64)	54	(84.4%)	10	(15.6%)
Total	(n = 351)	326	(92.9%)	25	(7.1%)

The author's overall experience with SN biopsy procedures (from June 1992 to October 1996) is summarised in Table I. The great majority of these procedures were performed for patients with primary melanomas exceeding 1.0 mm in thickness. The results reported exclude those obtained for miscellaneous node fields, e.g., when lymphatic drainage was directly to interpectoral, triangular intermuscular space, epitrochlear or popliteal nodes. Blue dye was used for SN identification in all the patients. However, preoperative lymphoscintigraphy was not performed in some who were treated early in the series, before the importance of this investigation had been fully appreciated, and only over the past 18 months has intraoperative use of a gamma probe become routine.

Micrometastatic melanoma was found in 68 of the 308 patients (21.4%) in whom the 351 procedures were performed. Although the confident SN identification rate for the groin is shown as 100%, a second blue stained sentinel node in one patient was missed at the time of SN biopsy, and only found in the specimen from the full elective lymph node dissection subsequently performed [11]. In the neck, both preoperative lymphoscintigraphy and intraoperative use of the gamma probe were sometimes unhelpful in locating SNs; this was because the primary melanoma site (which remained hot following the labelled colloid injection) either directly overlay or was in close proximity to the draining lymph nodes.

As continuing experience with the SN biopsy technique has been gained, the ability to confidently identify SNs has increased, so that success rates of over 95% for the axilla and over 90% for the neck are currently being achieved. This improvement is attributable not only to increased familiarity with the surgical technique, but also to the introduction of routine preoperative lymphoscintigraphy and routine use of a gamma probe intraoperatively. In all body sites intraoperative mapping with blue

dye remains the gold standard for accuracy of SN identification, but both lymphoscintigraphy and use of a gamma probe provide important additional information which minimises unnecessary dissection, reduces operation time and, most importantly, further increases the certainty of SN identification. As randomised trials to establish the clinical reliability and benefits of the SN biopsy procedure proceed in multiple centers around the world, it is clearly essential that the highest possible accuracy of SN identification is achieved.

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